I CLAIM:

1. An optical vector analyzer for analyzing the characteristics of a fiber-optic device under test (DUT) over a frequency range of interest and particularly with respect to the transfer of optical energy from an input of said device to an output of said device, said analyzer providing four arrays of constants for a Jones matrix characterizing the device under test, said system comprising:

(1) a source of light having an optical frequency content over said frequency range of interest, said source of light feeding a spinner providing a spinner light output having a polarization state which varies linearly with said frequency, said spinner light output provided as an input to both said DUT and a reference path;

(2) a beam combiner for adding a light output from said reference path and a light output from said DUT for a plurality of frequencies in said frequency range of interest and providing an output indicative of optical power, in two orthogonal polarization states, of said combined light; and

(3) a microprocessor responsive to said power outputs and programmed to

digitize said power outputs over a plurality of frequencies in said frequency range of interest,

derive respective curves from said detector output,

calculate the Fourier transform of said respective curves, and

derive from said Fourier transforms, said four arrays of constants for said Jones matrix, thereby characterizing said device under question.

2. An optical vector analyzer according to claim 1, wherein said source of light is comprised of a narrow linewidth tunable source of light.

3. An optical vector analyzer according to claim 2, wherein said tunable source of light is a tunable laser.

4. An optical vector analyzer according to claim 3, wherein said microprocessor is also responsive to said source of light.

5. An optical vector analyzer according to claim 1, wherein said source of light is a broadband optical source.

6. An optical vector analyzer according to claim 1, wherein said beam combiner is comprised of:

a coupler adding the reference path output and the DUT output; and

a polarizer splitting the added outputs into said two orthogonal polarized outputs.

7. An optical vector analyzer according to claim 6, wherein said coupler is a bulk-optic beam splitter.

8. An optical vector analyzer according to claim 6, wherein said coupler is a fused tapered coupler.

9. An optical vector analyzer according to claim 1, wherein said microprocessor includes a spectral acquisition device for measuring the optical power of the light in the two orthogonal polarization states.

10. An optical vector analyzer according to claim 1, wherein said microprocessor includes an optical spectrum analyzer for measuring the power of the detected output in the frequency range of interest.

11. An optical vector analyzer according to claim 9, wherein said source of light is a tunable laser , and a sample of said laser light is provided to said spectral acquisition device, said spectral acquisition device is comprised of:

a Michelson interferometer supplied with said laser light sample for generating a trigger light signal;

a trigger detector, responsive to said trigger light signal, providing a power acquisition trigger signal; and

two power detectors, each power detector measuring the optical power in one of said tow orthogonal polarization states.

12. An optical vector analyzer according to claim 11, wherein said interferometer is comprised of:

a two way coupler for splitting said laser light sample into two optical signals;

two optical paths, each path having two ends, one of said two ends receiving one of said two optical signals from said coupler, one of said optic paths is longer than the other of said optical paths; and

two Faraday rotator mirrors, one of said mirrors connected to the other end of each of said two optical paths, wherein said laser light sample is phase delayed in said longer path relative to the shorter path and reflected by said mirrors back to said coupler, wherein said reflected signals are combined and are coupled to said trigger detector.

13. An optical vector analyzer according to claim 12, wherein said spectral acquisition device further includes:

a coupler to provide a portion of said laser light sample; and

a frequency monitor, responsive to said portion of said laser light sample, for providing an output indicative of the wavelength of said laser light sample.

14. An optical vector analyzer according to claim 1, wherein said combiner is comprised of:

a polarization controller for adjusting the polarization of the recombined portions of light;

a polarizing beam splitter, responsive to said polarization controller, for splitting said recombined light into x- and y- polarization components; and

s- and p- detectors, responsive to said x- and y- polarization components, respectively, for providing an electrical signal indicative of the amplitude of the x- and y- polarization components.

15. An optical vector analyzer according to claim 14, wherein said polarization controller is adjusted to provide a nulled alignment in which the relative phase of the two states of polarization at the coupler does not affect a power splitting ratio at said polarization beam splitter.

16. An optical vector analyzer according to claim 14, wherein said polarization controller is adjusted to provide a maximum contrast alignment in which the relative phase of the two states of polarization at the coupler provides a maximum amount of power at one of the detectors and, at the same time, provides a minimum amount of power at the other of the detectors.

17. A spinner for modifying light from a source into light having a polarization which varies linearly with respect to variations in optical frequency of the source light over a frequency range of interest, said spinner comprising:

a splitter for splitting said light from said source into two portions of light;

two separate light paths, each path supplied with a portion of said light, each light path having a Jones matrix which is independent of wavelength of said light, each path having a Jones matrix different from the Jones matrix of the other path such that, at the end of each path, light transmitted along the two paths is mutually orthogonal, and

a spinner combiner for combining light from said two paths, where a combined light output has a polarization state which varies linearly with frequency variation of said light from said source.

18. A spinner according to claim 17, wherein said splitter comprises a polarization maintaining coupler for splitting said light from said source.

19. A spinner according to claim 17, wherein said splitter comprises a single mode coupler for splitting said light from said source.

20. A spinner according to claim 17, wherein said spinner includes at least one polarizer controller, located in at least one of said two paths, for controlling polarization in at least one of said two paths to provide mutually orthogonal light at the spinner combiner.

21. A spinner according to claim 20, wherein a portion of the combiner output is provided to a nulling detector for providing an electrical output indicative of the phase relationship of light in said two paths.

22. An optical vector analyzer for analyzing the characteristics of a fiber-optic device under test (DUT) over a frequency range of interest and particularly with respect to the transfer of optical energy from an input of said device to an output of said device, said analyzer providing four arrays of constants for a Jones matrix characterizing the device under test, said system comprising:

(a) a narrow linewidth tunable source of light for providing a varying optical frequency light over said frequency range of interest, said light having an initial polarization,

(b) a spinner, supplied with said light, comprised of

(1) a splitter for splitting said light from said source into two portions of light;

(2) two separate light paths, one path comprising a long path and the other path comprising a short path relative to said long path, each path supplied with one portion of said light, each light path having a Jones matrix which is independent of wavelength of said light, each path having a Jones matrix different from the Jones matrix of the other path such that, at the end of each path, light transmitted along the two paths is mutually orthogonal,

(3) a spinner combiner for combining light from said two paths, where, as a result of the path length difference, a combined light output from the combiner has a polarization state which varies linearly with frequency variation of said light from said source, said light provided as an input to both said DUT and a reference path;

(c) a beam combiner for adding light from said reference path and from said DUT for a plurality of frequencies in said frequency range of interest and for providing an output indicative of optical power, in two orthogonal polarization states, of said combined light;

(d) a spectral acquisition block for measuring said optical power with respect to wavelength for said plurality of frequencies; and

(e) a microprocessor, responsive to said measured power and programmed to

(1) digitize said measured power for said frequencies,

(2) derive respective curves from said digitized power measurements, and

(3) calculate the Fourier transform of said respective curves, and

(4) derive from said Fourier transforms, said four arrays of constants for said Jones matrix, thereby characterizing said device under question.

23. An optical vector analyzer according to claim 22, wherein said tunable source of light is comprised of a laser.

24. An optical vector analyzer according to claim 22, wherein said splitter comprises a polarization maintaining coupler for splitting said light from said source.

25. An optical vector analyzer according to claim 22, wherein said splitter comprises a single mode coupler for splitting said light from said source.

26. An optical vector analyzer according to claim 22, wherein said spinner includes at least one polarizer controller, located in at least one of said two paths, for controlling polarization in at least one of said two paths to provide mutually orthogonal light at the spinner combiner.

27. An optical vector analyzer according to claim 22, wherein a portion of the combiner output is provided to a nulling detector for providing an electrical output indicative of the phase relationship of light in said two paths.

28. An optical vector analyzer according to claim 22, wherein said beam combiner is comprised of:

a coupler adding the reference path output and the DUT output; and

a polarizer splitting the added outputs into said two orthogonal polarized outputs.

29. An optical vector analyzer according to claim 22, wherein said combiner is comprised of:

a polarization controller for adjusting the polarization of the recombined portions of light;

a polarizing beam splitter, responsive to said polarization controller, for splitting said recombined light into x- and y- polarization components; and

s- and p- detectors, responsive to said x- and y- polarization components, respectively, for providing an electrical signal indicative of the amplitude of the x- and y- polarization components.

30. An optical vector analyzer according to claim 29, wherein said polarization controller is adjusted to provide a maximum contrast alignment in which the relative phase of the two states of polarization at the coupler provides a maximum amount of power at one of the detectors and, at the same time, provides a minimum amount of power at the other of the detectors.

31. An optical vector analyzer according to claim 22, wherein said coupler is a fused tapered coupler.

32. An optical vector analyzer according to claim 22, wherein said microprocessor includes a spectral acquisition device for measuring the optical power of the light in the two orthogonal polarization states.

33. An optical vector analyzer according to claim 22, wherein said microprocessor includes a spectral acquisition device for measuring the optical power of the light in the two orthogonal polarization states.

34. An optical vector analyzer according to claim 33, wherein said source of light is a tunable laser , and a sample of said laser light is provided to said spectral acquisition device, said spectral acquisition device is comprised of:

a Michelson interferometer supplied with said laser light sample for generating a trigger light signal;

a trigger detector, responsive to said trigger light signal, providing a power acquisition trigger signal; and

two power detectors, each power detector measuring the optical power in one of said tow orthogonal polarization states.

35. An optical vector analyzer according to claim 34, wherein said interferometer is comprised of:

a two way coupler for splitting said laser light sample into two optical signals;

two optical paths, each path having two ends, one of said two ends receiving one of said two optical signals from said coupler, one of said optic paths is longer than the other of said optical paths; and

two Faraday rotator mirrors, one of said mirrors connected to the other end of each of said two optical paths, wherein said laser light sample is phase delayed in said longer path relative to the shorter path and reflected by said mirrors back to said coupler, wherein said reflected signals are combined and are coupled to said trigger detector.

36. An optical vector analyzer according to claim 35, wherein said spectral acquisition device further includes:

a coupler to provide a portion of said laser light sample; and

a frequency monitor, responsive to said portion of said laser light sample, for providing an output indicative of the wavelength of said laser light sample.

37. An optical vector analyzer for analyzing the characteristics of a fiber-optic device under test (DUT) over a frequency range of interest and particularly with respect to the transfer of optical energy from an input of said device to an output of said device, said analyzer providing four arrays of constants for a Jones matrix characterizing the device under test, said system comprising:

(a) a source of broadband light having a frequency band over said frequency range of interest, said light having an initial polarization,

(b) a spinner, supplied with said light, comprised of

(1) a splitter for splitting said light from said source into two portions of light;

(2) two separate light paths, one path comprising a long path and the other path comprising a short path relative to said long path, each path supplied with one portion of said light,

(3) a spinner combiner for orthogonally combining light from said two paths, where, as a result of the path length difference, a combined light output from the combiner has a polarization state which varies linearly with frequency of said light from said source, said light provided as an input to both said DUT and a reference path;

(c) a beam combiner for adding light from said reference path and from said DUT for a plurality of frequencies in said frequency range of interest and providing a beam combiner output;

(d) an optical spectrum analyzer, responsive to said beam combiner output, for achieving a minimum resolution bandwidth of no more than one fourth the bandwidth of said frequency range of interest and providing an output; and

(e) a microprocessor, responsive to said spectrum analyzer output and programmed to:

(1) derive respective curves from said analyzer output;

(2) calculate the Fourier transform of said respective curves, and

(3) derive from said Fourier transforms, said four arrays of constants for said Jones matrix, thereby characterizing said device under question.

38. An optical vector analyzer according to claim 37, wherein said splitter comprises a polarization maintaining coupler for splitting said light from said source.

39. An optical vector analyzer according to claim 37, wherein said splitter comprises a single mode coupler for splitting said light from said source.

40. An optical vector analyzer according to claim 37, wherein said spinner includes at least one polarizer controller, located in at least one of said two paths, for controlling polarization in at least one of said two paths to provide mutually orthogonal light at the spinner combiner.

41. An optical vector analyzer according to claim 40, wherein a portion of the combiner output is provided to a nulling detector for providing an electrical output indicative of the phase relationship of light in said two paths.

42. An optical vector analyzer according to claim 37, wherein said beam combiner is comprised of:

a coupler adding the reference path output and the DUT output; and

a polarizer splitting the added outputs into said two orthogonal polarized outputs.

43. An optical vector analyzer according to claim 37, wherein said combiner is comprised of:

a polarization controller for adjusting the polarization of the recombined portions of light;

a polarizing beam splitter, responsive to said polarization controller, for splitting said recombined light into x- and y- polarization components; and

s- and p- detectors, responsive to said x- and y- polarization components, respectively, for providing an electrical signal indicative of the amplitude of the x- and y- polarization components.

44. An optical vector analyzer according to claim 37, wherein said optical spectrum analyzer is comprised of a grating spectrometer.

45. An optical vector analyzer according to claim 37, wherein said microprocessor includes a spectral acquisition device for measuring the optical power of the light in the two orthogonal polarization states.

46. An optical vector analyzer for analyzing the characteristics of a fiber-optic device under test (DUT) over a frequency range of interest and particularly with respect to the transfer of optical energy from an input of said device to an output of said device, said analyzer providing

four arrays of constants for a Jones matrix characterizing the device under test, said system comprising:

(a) a source of light having an optical frequency content over said frequency range of interest, said source of light providing two mutually coherent light beams, each of said light beams feeding a spinner providing a spinner light output having a polarization state which varies linearly with said frequency, and said spinner light outputs having different rates of change of polarization with respect to change of frequency of the light beam, one of said spinner light outputs comprises an input to said DUT and the other of said spinner light outputs comprises an input to a reference path;

(b) a beam combiner for adding light output from said reference path and light output from said DUT over said frequency range of interest and providing a detected output; and

(c) a microprocessor, responsive to said detected output and programmed to

(1) digitize said detected output over a plurality of frequencies at said frequency range of interest,

(2) derive respective curves from said digitized outputs,

(3) calculate the Fourier transform of said respective curves, and

(4) derive from said Fourier transforms, said four arrays of constants for said Jones matrix, thereby characterizing said device under test.

47. An optical vector analyzer according to claim 46, wherein a portion of the combiner output is provided to a nulling detector for providing an electrical output indicative of the phase relationship of light in said two paths.